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Cross-Border Electricity Cooperation in South Asia

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Abstract

South Asian countries, facing challenges in efficiently meeting growing electricity demand, can benefit from increased cross-border electricity cooperation and trade by harnessing complementarities in electricity demand patterns, diversity in resource endowments for power generation, and gains from larger market access. The region has witnessed slow progress in expanding regional electricity cooperation and trade, and undertaking needed domestic sector reforms. Although bilateral electricity sector cooperation in the region is increasing, broader regional cooperation and trade initiatives have lagged in the face of regional barriers and domestic sector inefficiencies. Deeper electricity market reforms are not a necessity for further development of cross-border electricity trade, but limited progress in overcoming regional and domestic barriers will limit the scope of the regional market and the benefits it can provide.

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Cross-Border Electricity Cooperation in South Asia

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Cross-Border Electricity Cooperation in South Asia[1]

1. Introduction

Access to reliable, affordable and cleaner energy is a high priority to facilitate further economic development and improved welfare of the population in the South Asia region (SAR).[2] Access to adequate and high-quality energy is part of a larger effort toward reducing adverse impacts of infrastructure scarcity in the region (Andres, Biller and Dappe 2013a, 2013b; Ghosh Banarjee et al, 2015). In SAR, poor access to electricity combines with unreliable supply due to chronic electricity shortages and unexpected interruptions.[3] Shortages and unpredictable availability of electricity also have led to costly and environmentally harmful investment in small-scale back-up generators (World Bank 2013a, 24).

Strengthening cross-border electricity cooperation in South Asia can be part of the solution for providing adequate and reliable electricity availability. One reason is that there are complementarities in electricity demand and resource endowments among these countries due to diversity of primary energy resources and differences in seasonal patterns of supply and demand. In addition, increased electricity cooperation and trade among countries can bring economies of scale in investments, strengthen electricity sector financing capability, enhance competition and improve sector efficiency, and enable more cost-effective renewable electricity penetration (Timilsina et al, 2015; Singh et al., 2013; ESMAP, 2010;Srivastava and Mishra, 2007; Thakur, 2004).For example, Nepal and Bhutan have comparative advantages in hydropower

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[2]In this paper, the South Asia Region (SAR) refers to Bangladesh, Bhutan, India, Nepal, Pakistan, and Sri Lanka. Afghanistan and Maldives also are in this region as it is defined by the world Bank, but we do not cover them in this paper..

[3]The countries in the South Asia region are home to around 1.57 billion people (23.7% of global population), while covering only around 4% of the global landmass. Around 493 million people lived devoid of any electricity access across South Asia in 2009, despite electricity sector reforms in the region (IEA, 2011). In 2010, average per capita electricity consumption in the region was recorded to be 563 kWh as compared to the world average of 2977 kWh (Singh et al., 2013).

production that can only be realized with cross-border trade. Those countries also experience significant declines in hydroelectric generation during the winter season, and thus would benefit from improved access to thermal-based electricity generation from neighboring countries.

Efforts to expand cross-border electricity cooperation and trade in SAR need to be address several barriers. Some of these reflect elements of the regional-level political climate, while others arise due to limited scope and extent of domestic electricity sector policies and renovations. Review of the reform process and identification of barriers to cross-border electricity trade are the main objectives of this paper.

The remainder of the paper is structured as follows. Section 2 reviews the status of cross-border electricity cooperation in SAR. Section 3 identifies key regional-level barriers to expanding cross-border cooperation and trade in SAR. Section 4 discusses the extent to which current domestic sector policies impede greater cross-border electricity cooperation. Section 5 summarizes the findings of the paper and offers some policy recommendations for moving ahead on increased cross-border trade and cooperation.

2. Current Status of Cross-Border Electricity Cooperation in South Asia

Increased regional electricity cooperation can be seen as part of a larger interest in expanded trade and cross-border market integration. General interest in regional economic cooperation has existed for some time in SAR; it predates the formation of South Asian Association for Regional Cooperation (SAARC) in 1985. The agreement for a South Asian Free Trade Area (SAFTA) signed in 2004 envisioned a transition toward a common market. Tangible expressions of the interest in regional energy cooperation followed soon after the formation of SAFTA. The South Asia Regional Energy Coalition (SAREC) in 2006 was formed to promote advocacy initiatives by leading policy-oriented business associations in South Asia. The SAARC Energy Centre (SEC), established in 2006 as a Special Purpose Vehicle (SPV) with its base in Islamabad, Pakistan, also has had a focus on regional energy sector cooperation in South Asia.

In late 2014, SAARC member states agreed to a "framework agreement" for regional cooperation in electricity.[4] The agreement contains broad-ranging provisions for the establishment of a regional market for electricity, including nondiscriminatory access to transmission, market-based pricing of electricity exchanged, and establishment of a body for coordinating regional power integration and trade. It remains to be seen how extensively or rapidly these provisions will be put into practice.

At present simple bilateral arrangements for power transmission and trade are predominant. In particular, bilateral generation and transmission arrangements between Nepal-India, India-Bhutan and most recently India-Bangladesh dominate regional electricity cooperation in South Asia (Singh et al., 2013; Srivastava and Mishra, 2007; Paudyal, 2013). Table 1 summarizes the current state of cross-border arrangements for electricity sector cooperation in South Asia. These bilateral relationships are mostly based on government-to-government relationships, with a limited to minimal role played by the private sector. [5]

2.1. Nepal-India Electricity Cooperation

Nepal relies heavily on energy imports from India, which includes importing energy products like electricity, diesel generations and petroleum products and inverters. The history of bilateral electricity cooperation between Nepal and India dates back to as early as 1920s. The Kataiya powerhouse, and Trishuli, Devighat and Phewa hydropower projects were some of the initial government-to government hydroelectric schemes implemented in Nepal with the financial and technical assistance from the Government of India (GoI). Development of the 1 MW hydroelectric project in 1968 at Pokhara with the Indian assistance laid the foundation for how broader electricity sector cooperation between Nepal and India. This was followed up by a 21 MW plant at Trisuli (1969), 15 MW plant on Western Gandak

[4]See http://www.saarc-sec.org/userfiles/SAARC-FRAMEWORK-AGREEMENT-FOR-ENERGY-COOPERATION-ELECTRICITY.pdf.

[5]The private sector is starting to become more involved in cross-border power projects. A number of Indian investors are developing large power projects in Nepal, part of which can serve the export market. A number of power generation projects in Bhutan as well Nepal are witnessing participation of private investors, including those from within South Asia. As of December 2014, 161 mostly small hydro projects (totaling about 2000 MW) have been developed and are under development in Nepal. Most of the small projects are being developed by the private investors.

(1979) and 14.1 MW plant at Devi Ghat (1983). By 1971, Nepal and India had signed a Power Purchase Agreement with limited low-capacity exchange at various locations along the Nepal-India border. Under this border town exchange program, electric utilities in Nepal and India (Bihar) provide access to electricity to the towns that are accessible easily from across the border through a number of 11 kV and 33 kV cross-border interconnections.

Participants	***Cross-border electricity trade***
India – Nepal	Nepal imported 793GWh electricity in 2013 from India over multiple interconnections.
India-Bhutan	Electricity import from Bhutan to India was 5556 GWh in 2013-14 (4627 GWh in 2012-13) from Hydro power stations at Tala, Chukha and Kurichu with a total export led capacity of 1416 MW. As per an umbrella agreement between the two countries, India assures a minimum of 5000 MWelectricity import by 2020.
Pakistan-Iran	Pakistan imported 419 GWh electricity in 2014 from Iran, up from 375 GWh in the previous year.
Afghanistan-Central Asia	Import of 2,246.2 GWh electricity from Iran, Uzbekistan, Turkmenistan, and Tajikistan in 2011. CASA-1000 expected to enhance this trade.
Pakistan-India	Pakistan has submitted a draft MoU to India on importing electricity using a 1200 MW interconnection. There are also possibilities of CASA to be extended to India.
India-Sri Lanka	Feasibility studies for a 400-kV India-Sri Lanka have been conducted to support import of up to 1000 MW electricity from India.
India-Bangladesh	In 2013, power systems of India and Bangladesh were interconnected through a HVDC line that can support electricity export of up to 500 MW (expandable to 1000 MW in future) from India to Bangladesh based on negotiated price and market based price.

Table 1: Existing and some proposed cross-border electricity trade arrangements in South Asia

Source: Compilation from Singh et al. (2013), NTDC (2014), ERLD (2014)

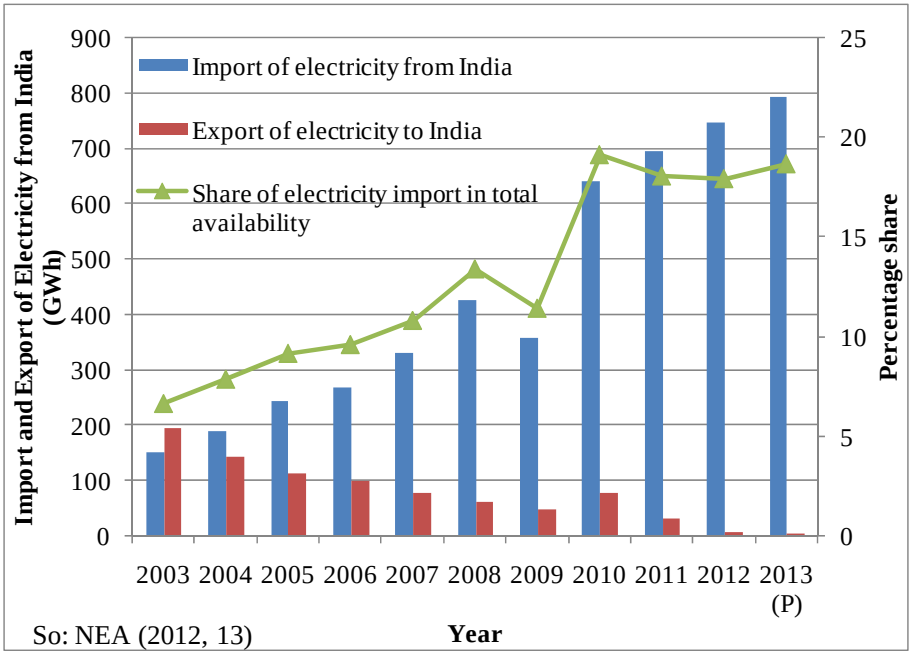
The two countries signed a treaty in 1996 for integrated development of the Mahakali River basin, including Sarada barrage, Tanakpur barrage and Pancheshwar projects. In July 2001, the GoI nominated the Power Trading Corporation (PTC) as the nodal agency to deal with matters relating to power exchange with Nepal (Mittra, 2012). PTC is also the sole agency from the Indian side for finalizing commercial and technical arrangements/systems with the Nepal Electricity Authority (NEA) and coordinating with associated Indian agencies. A power trade agreement was signed between Nepal and India in October 2014 to expand the bilateral electricity trade between the two nations. The completion of two double-circuit transmission corridors

between Dhalkebar-Muzaffarpur (90 kms) and Hetaua-Duhabi (40 kms) (partly funded by the World Bank), coupled with the operation of a combined 20,000 MW capacity of hydropower projects undergoing feasibility study in Western Nepal is expected to increase the electricity trade between India and Nepal.

Generation capacity addition in Nepal significantly lags behind growing electricity demand, making Nepal a net importer of electricity from India (Figure 1). Electricity imports now account for nearly 20% of the total availability. Given the existing demand-supply mismatch in Nepal, it may continue to import electricity from India through the upcoming interconnections in the short-term. However, it can become a net exporter of electricity as the country develops its vast hydroelectric potential.

Figure 1: Changing Balance of Electricity Trade between Nepal and India

Source: NEA (2013)



So: NEA (2012, 13)

2.2. Bhutan-India Electricity Cooperation

Bhutan conducts 80% of its total trade with India; electricity trade constitutes 45% of Bhutan's total exports. Electricity is Bhutan's principal export commodity and the largest revenue earner (ADB, 2013). In 2011-12, earnings from export of electricity to India accounted for 11.4% of the country's GDP (Singh et al., 2013). The bilateral arrangements between India and Bhutan started with the Jaldhaka Agreement in 1961. The first hydroelectric plant (Joshina) of 360 kW capacity was commissioned in 1967

under the grant assistance of the GoI. Bilateral electricity connections from West Bengal and Assam were set up to electrify bordering villages and towns in Bhutan in the 1970s and 80s. The Chukha agreement was signed in 1974 for the joint development of a 336 MW hydropower plant (construction completed in 1988) in Bhutan between the GoI and the Royal government of Bhutan (RGoB) with financial assistance from India. Another agreement was signed between the GoI and RGoB in 1994 for the joint development of the Kurichhu hydropower plant (60 MW) in 1994 while the construction was completed in 2001-2002. Similarly, the Tala agreement was signed between the GoI and RGoB in 1996 while the construction of the Tala hydropower project (1020 MW) was completed in 2006. In 2006, an umbrella agreement was signed by the two countries to facilitate and cooperate in hydropower development and trade through public and private sector participation. Under this agreement, India agreed to import at least 5000 MW from Bhutan by 2020 (Singh et al., 2013). The PTC is the nodal agency responsible for the purchase and sale of power from Bhutan to India.

Apart from gaining significant export income, a minimum 12% royalty from power projects prompted the Royal Government of Bhutan to target 100% electrification in the country by the end of 2013, while ensuring continuity of lifeline electricity consumption to its population. Access to thermal power from India during the dry winter season highlights mutual benefits of interdependency of the two power systems.

2.3. India-Bangladesh Electricity Cooperation

In January 2010, Bangladesh and India signed a memorandum of understanding (MOU) to exchange electricity through a cross-border interconnection leading to development of a 400 kV, 30-km double-circuit HVDC line from Bheramara (Bangladesh) to Baharampur (India) and a 500 MW 400/230 KV back-to-back HVDC substation at Bheramara. The link has an initial capacity of 500 MW, which can be later expanded to 1000 MW (Singh et al., 2013). An electricity purchase pact was inked between NTPC VidyutVyapar Nigam in India and Bangladesh Power Development Board (BPDB) in Bangladesh in early 2012 for the import of electricity to Bangladesh. The 25-year government-to-government electricity purchase deal involves providing 250 MW of coal-fired electricity from India to Bangladesh. On

December 4, 2013, the full transmission power capacity of 500 MW was achieved (Brady, 2014). The Asian Development Bank (ADB) financed the project under an India-Bangladesh power exchange initiative.

3. Barriers to Cross-Border Electricity Cooperation

The scope and extent of cross-border electricity cooperation varies across regions (Pineau, Hira and Froschauer, 2004; Oseni and Pollitt, 2014). Regional electricity cooperation for market integration typically evolves in the wake of bilateral cross-border electricity trade arrangements. The more advanced arrangements incorporate shared generation assets and multi-country trading through integrated competitive markets.

Regional agreements for power sector cooperation and trade can take time to achieve. For example, realization of the Central American Power Market (SIEPAC for its Spanish initials) took 23 years from the time the feasibility study was completed. Similarly, electricity sector cooperation in the Greater Mekong Sub-region (GMS) also witnessed a timeline spread over two decades, and still continues to evolve.

Slow progress of cross-border electricity trade can be attributed to technical, operational, political and commercial issues. These vary according to socio-economic and political circumstances in the region. A number of electricity cooperation initiatives around the world have faced some common challenges, even in sophisticated OECD electricity systems (ESMAP, 2010). For example, transmission and trade cooperation arrangements, such as the Southern Africa Power Pool and the West African Power Pool, have failed to realize their full potential without development and timely implementation of a long-term transmission plan, and differing expectations of electricity prices by buyers and sellers (Singh et al., 2013).

Arguably, the current state and magnitude of electricity cooperation and trade in SAR is far less than the potential considering the regional diversity of energy resource endowments and differences in demand patterns across countries in the region (Wijayatunga and Fernando, 2013; Singh et al., 2013,Timilsina et al, 2015). We focus in this section on three regional-level barriers. In the next section we consider

how weaknesses in domestic sector policies also impede cross-border cooperation and trade.

3.1. Dynamic and Uncertain Regional Political Climate

Historical animosity or lack of trust has often frustrated the process of regional cooperation in South Asia, including regional power sector cooperation. While there are encouraging signs, political rhetoric for electricity cooperation has not consistently translated into the political will and action for cooperation in South Asia (Paudyal, 2013). Internal political conflicts also have slowed down the process of regional electricity sector cooperation. In addition, the government-to-government model for cross-border trade typically involves lengthy political as well as technical negotiations, diminishing economic gains.

Regional cooperation is perceived by some as a threat to national safety and energy security, as reflected in debates over power trade between India and Pakistan (Mukherji and Chaturvedi, 2013). In another case, inability of the Bangladeshi government to provide a guaranteed supply of natural gas for a proposed USD 3 billion power project investment in Bangladesh by an Indian company resulted in the latter abandoning the business venture altogether (Rahman et al., , 2012). On the other hand, entry of Chinese investment has prompted India to explore electricity cooperation with Sri Lanka and Nepal (Chaturvedi, 2013; Mittra, 2012).

The ability of the cross-border trade of electricity to address public interest, social and environmental concerns has been questioned (Williams and Ghanadan, 2006). For example, large-scale development of water resources in Nepal and Bhutan will generate significant economic rents. Debates over the distribution of such rents can generate conflicts and opposition to large-scale resource development initiatives.

3.2 Absence of a Platform for Cross-Border Regulatory Coordination

Increased electricity cooperation and trade in the region requires national regulators to pay more attention to harmonization and coordination of their regulatory practices. Technical aspects such as rules and procedures concerning transmission access and its pricing, congestion management, operational codes and protocols for system operation, energy accounting and payment thereof, and data transfer protocols need to

be gradually harmonized for seamless and stable operation of the transmission systems.[6]

3.3. Tariff and Non-Tariff Market Barriers

Like other commodities and services, trade in electricity is hindered by export tax, import duty and transit tax. The South Asian Free Trade Agreement (SAFTA), when signed, did not give special treatment to energy, particularly electricity trade. Although signing in 2014 of the SAARC Framework Agreement for Energy Cooperation (Electricity) during 18th SAARC Summit in Kathmandu has given impetus to expanded regional power trade, more needs to be done for implementation of a regional agreement for free trade of electricity. For example, electricity import licensing restrictions in India that limit participation to specifically identified (so-called nodal) agencies also limit entry in cross-border trade and hinder the development of power exchange (Singh et al., 2013).

Power sector trade-related reforms also are inter-dependent with wider reforms, and failure to harmonize inter-sector reforms can lead to power sector reform measures being ineffective (Nepal and Jamasb, 2012b). For example, India and Sri Lanka are yet to sign a free trade agreement, while India also has been reluctant to waive imports duty for imported construction equipment and materials to Nepal from a third country. Similarly, Pakistan is yet to grant Most Favored Nation (MFN) status to enhance trade with India.

4. Impact of National Electricity Sector Policies on Cross-Border Cooperation and Trade in South Asia

In addition to regional-level barriers to increased cross-border electricity cooperation and trade in SAR, weaknesses in domestic sector policies also create impediments. To build the case for this assertion, in this section we review the status of sector policies and performance in SAR.

[6] Establishing a SAARC level Transmission System Operator (TSO) or Coordination Forum of System Operators is an option as national transmission grids get increasingly integrated. HVDC interconnections, while costly, allow some flexibility due to asynchronous operation of the interconnected power systems.

4.1 Overview of Power Sector Reforms in South Asia

Countries in the South Asia region initiated national electricity sector reforms following somewhat different timelines, as shown in Table 2 below.[7] The process of reform in the power sector was undertaken to address several ongoing problems: the fiscal burden of price subsidies and low revenue collection rates, and the economic burden of low service quality, and high network losses experienced under largely state-owned and controlled systems (Newbery, 2002, Singh, 2006). One of the objectives of sector reform in SAR (as elsewhere) is to attract more domestic and foreign private sector investments (Singh, 2007). Other objectives include reducing dependence on state support and ensuring affordable and reliable service quality (Lama et al., 2002).To accomplish these aims, it is ultimately necessary to manage sector activities in a more economically efficient and competitive manner.[8]

As indicated in Table 2, the single buyer model (SBM) (*one buyer and many sellers*) dominates the wholesale generation market arrangements across the region. Only India has introduced a degree of competition in wholesale markets for electricity, and a day-ahead market (Singh 2010; Thakur et al., 2005). Vertically integrated incumbent electric utilities in Pakistan and India have undertaken functional unbundling (Singh et al., 2013). Most of the larger states in India have unbundled the erstwhile State Electricity Boards (SEBs) into separate corporatized entities for generation, transmission and distribution. Due to a provision of the Electricity Act of 2003, the bulk power procurement activity of the unbundled transmission utilities has been separated out from the provision of transmission.

Partial unbundling has been undertaken in Bhutan, as well as Sri Lanka. By law, Bhutan has designated a government entity to be the single buyer of electricity for all power projects, including the private ones. The electricity sector in Bangladesh is

[7] The appendix contains more details on national sector policy changes in individual SAR countries.

[8] Market reform approaches have been influenced to a greater or lesser extent by the "standard sector reform" model, which gained prominence in policy and analytical circles in the early 1990s. The standard model for electricity reform involves the following reform sequence and steps (Victor, 2005; Jamasb, 2006): i) establishment of an independent sector regulator; ii) corporatization of state-owned enterprises; iii) establishment of laws for electricity sector liberalization; iv) unbundling (or vertical separation) of the main industry segments (generation, transmission, distribution); v) implementation of more incentive-based regulation of electricity networks, to induce improved performance; vi) establishment of a wholesale electricity market; vii) privatization; and viii) introduction of independent power producers (IPPs).

horizontally unbundled with separate entities, catering to the requirements of the rural and urban areas. A legislative initiative has been advanced to unbundle the Nepal Electricity Authority. However, the fate of this remains unclear due to the persistent political uncertainty in the country.

Table 2: Status of major reform elements in South Asia
Source: Compiled by the Authors.

Country	***Nominal generation market structure***	***Initiation of private ownership and/or participation:***			***Introduction of legally independent regulator***	***Transmission Arrangement***
		Genera-tion	Trans-mission	Distri-bution		
Bangladesh	Multiple sellers, single buyer	1992			2003	Unbundled transmission owner
Bhutan	Multiple sellers, single buyer	2008				Vertically integrated
India	competition with organized trading, but includes SOEs	1991	2000	1999 (Orissa); 2002 (Delhi)	1996 (Orissa); 1998 (national)	Unbundled transmission and independent system operator[9]
Nepal	Multiple sellers, single buyer	1992			1994/2011	Vertically integrated
Pakistan	Multiple sellers, single buyer	1994	1995	1998 (KESC)	1995	Unbundled transmission owner
Sri Lanka	Multiple sellers, single buyer	1996			2002/2009	Vertically integrated

The ownership of the generation segment is mixed. There is private sector participation in the form of IPPs in Bangladesh, India, Nepal, Pakistan and Sri Lanka. However, the bulk of generation assets remain state-owned, and many of the IPPs constitute small-scale and costly plants that started operation as a response to crises in electricity availability, particularly in Bangladesh and Pakistan.

Transmission and distribution remain largely under government ownership across the region. In India, private investors are permitted to invest in creation of transmission

[9] System operator continues to be bundled with the transmission utility at the state-level.

infrastructure under a license. A number of transmission links have been created in this manner including those between Bhutan and India, which have been constructed under a joint ownership agreement between the private investors and the government of India. The Indian states of Delhi and Orissa,[10] and one distribution area in Pakistan (in Karachi) are the only examples of privatized electricity distribution in the region.

Independent regulatory commissions have been introduced in the majority of SAR countries. The process is still pending in Nepal (Nepal and Jamasb, 2012a), and remains partially implemented in Bhutan. More generally, the reform process has been slow in most of the SAR countries. In Sri Lanka, for example, a new Electricity Act was enacted only in 2009. Even in India, where the reform process has operated for almost two decades, politics and reform remain intertwined (Dubash and Rao, 2008; Tongia, 2007).

In India, market-oriented reform has had to face a number of challenges, although market-oriented activity including short-term competitive power markets is increasing (Littlechild, 2013). There is evidence that reform in India since the early 1990s has improved operational efficiencies (Cropper et al 2011), though effects are not necessarily realized immediately (Sen and Jamasb, 2012). While the country has embraced deeper market reforms that improved competition in the generation sector, the distribution sector continues to exhibit serious operational inefficiency as well as financial losses (Pargal and Ghosh Banarjee, 2014).[11] Losses also are serious in Bangladesh and Pakistan, where prices remain below cost-recovery levels and, in Pakistan, rate increases approved by the regulator are overridden by the legislature.

4.2 Performance of National Electricity Policy Reforms

The reforms in the electricity sector in most of the SAR countries have been aimed mainly at enhancing operational performance, with relatively less emphasis on being "market-oriented". India remains an exception by opening up the sector to competition and adopting market-oriented policies. To accomplish the objective of

[10]All four electricity distribution companies in Orissa were privatized (three distribution companies to BSES Ltd, now Reliance Energy Ltd., and one to AES of USA). Due to regulatory and legal issues, however, AES exited the business and the control of that company fell back to the state government.
[11]Wolak (2008) argues that India's institutions for electricity regulation themselves need significant restructuring to support restructuring of the country's power sector.

improving operational and financial performance of the sector, it is important that reforms include cost-reflective electricity pricing and effective targeting of electricity subsidies to improve the financial viability of the sector, as well as gradually opening up the sector to increased competition.

The lack of cost reflective pricing in SAR has been a major contributor to financial problems of national power sectors. The inability of the sectors to generate sufficient surplus has affected the ability of the electric utilities to invest in capacity additions for electricity generation, transmission, and distribution. It also has stunted incentives for private sector entry in generation, even if the entry barriers for the same have been lowered or removed. Poor financial and operational performance in the electricity sectors of SAR countries reflects weaknesses in the structure and governance of the sector (Bhattacharya, 2007).

Many of the anticipated benefits of reforms have been realized only to a limited extent, if at all. The performance indicators summarized in Table 3 provide evidence supporting these assertions.[12] The specific problems include the following:

(i) Insufficient investment in generation capacity.

The pace of growth in investments in power generation across the SAR remains slow; it does not match the growth in electricity demand of existing consumers, or to the new consumers gaining electricity access. The result is a large number of rolling power outages (Nayar et al, 2012). For example, some rural areas in Pakistan experienced load shedding and blackouts up to 20 hours a day in 2012, while Nepal also experienced up to 14-hour daily power outages in 2013 (Sovacool et al., 2013). Against a peak demand of 6500 MW, Bangladesh experienced load shedding of 1000-1200 MW in 2011 (GoB, 2014a). Sri Lanka, which remains significantly dependent on hydro-electric generation, is prone to electricity shortages during droughts, even though the average shortages remain as low as two hours a day. Peak demand and energy shortages in India declined from 11.51 % and 17.97 %, respectively, in 1996-97, to 4.2 % and 4.5 %, respectively, by 2013-14, while the share of private investment grew to 34% by the end of March 2014 compared to a meager 3.6 % at the

[12] Kessides (2012) shows that these conditions persist in a number of developing countries, even after more than two decades of sectoral reforms and restructuring.

end of November 1994. Without that increase in private investment, power shortages could have been higher.

Table 3: Power sector performance indicators in South Asia (selected countries)

	Installed capacity (MW)	Peak demand met(MW)	Peak demand (MW)	IPPs/Private Sector share in installed capacity (%)	Electricity access rate (%)*	Technical losses (% of generation)	Per capita electricity consumption (kWh)
Bangladesh	8537	6434	8349	16.35	60	14.36	213
India #	243028	126793 $	131943 $	34.0	75	23.65	917
Nepal	720	569.6**	1094.6	33.33	76	25.03	106
Pakistan	23412	13445	18467	35.56	69	17	450
Sri Lanka	3312	2112***	2146	33.15	85	14	490

Sources: Bangladesh (BPDB, 2014); Nepal (NEA, 2013); Sri Lanka (CBSL, 2013), India (CEA, 2014); Pakistan (Kessides, 2013), * IEA (2011), ** excludes electricity imports capacity from India, *** based on 1.2 GW hydro plant not running during drought seasons, # As on March 2014, $ For March 2014

There are estimates indicating that inadequate power supply imposes significant costs on South Asian economies. For example, the cost of load shedding to the Pakistani economy was estimated to be PKR 1,272 billion (Pakistani Rupees) in 2011-12, equivalent to 6% of the economy (Saeed, 2013). Table 4, based on data from World Bank enterprise surveys, provides an assessment of the direct loss of economic output by electricity users due to electricity outages in South Asian countries, along with additional statistics indicating the degree of service unreliability in the region.

(ii) Low operational efficiency and service quality.

Technical losses (both transmission and distribution) are estimated to average 14–25% of electricity generation in the region (Smith, 2004). The technical losses are particularly high in Nepal, Afghanistan and Pakistan. The poor physical condition of the transmission and distribution (T&D) networks in the face of networks investment inadequacy is one of the important causes of high network losses (Palit and Chaurey, 2011). Lower T&D losses have been achieved by the relatively more efficient distribution utilities in India, and in Bangladesh and Sri Lanka. This indicates in turn thatmuch of the observed T&D losses of 35-40% across states in India are due to non-technical reasons. Lack of metering of all consumers remains a challenge for the

utilities and the regulatory commissions to arrive at an accurate estimate of network losses, and to separate out non-technical from technical losses (Singh, 2006).

Table 4: Loss of economic output due to electrical outages and impact unreliable electricity supply on busineess activity
Source: World Bank (2013) and Nayar et al. (2012)

Country	Economic value lost by enterprises due to electrical outages (As a % of sales)	Average time of outages per month (hours)	Percentage of firms citing electricity availability or reliability as a major or severe constraint for growth	Percentage of firms owning generators
Afghanistan (2007)	6.4	280	66	71
Bangladesh (2007)	10.6	113	78	52
Bhutan (2009)	4.3	8	6	18
India (2006)	6.6	---	32	41
Nepal (2009)	27.0	226	76	16
Pakistan (2007)	9.2	69	74	26
South Asia overall	10.7	139	53	43

The non-technical electricity losses due to power theft can involve fraud (meter tampering), stealing (illegal connections), billing irregularities such as non-payment, and corruption (Smith, 2004). In April 2014, power was cut off in 18 government buildings in Pakistan including the Presidential residence because of nonpayment of electricity bills. In Bangladesh, electricity theft was estimated to be at 14%. In India, a third of electricity is lost through non-technical losses each year (Min and Golden, 2014).

(iii) Weak financial performance. Electricity losses translate to lost revenues to the power companies and poor service quality, Revenue inadequacy, due to both non-technical losses and distorted tariffs, remains one of the grave concerns of the state-owned electric utilities in South-Asia. In Bangladesh, for example, accounts receivable, due to the electricity bills not paid, was equal into 8.7 months of unpaid electricity consumption in 1999- 2000. This improved to about 2 months by 2013-14 in a decade of electricity reform experience (GoB, 2014b). For its part, the Nepal Electricity Authority incurred a financial loss of Nepalese Rupees (NPR) 4 billion in

2012 due to overstaffing, weak management and heavy electricity leakage despite the tariff hike (NEA, 2013).[13]

During the 1990s, amounts due by the State Electricity Boards in India to central power sector utilities, coal companies and the railways rose to INR 414.7 billion (GoI, 2001). In 2002, following a one-time tripartite settlement, amounts due began to be securitized by the respective state governments (Singh, 2006).[14] However, mounting debts now face state electric utilities. The accumulated financial losses of the power sector in India increased from INR 190 billion in March 2005 to over INR 1070 billion by March 2010 (GoI, 2011). Total receivables for the power sector utilities swelled from INR 3100 billion in March 2005 to over INR 5600 billion in March 2010 (GoI, 2011). In some states the arrearages were the equivalent of well over a year of unpaid power consumption.[15]

In Pakistan, the sector is suffering from a growing "circular debt" problem. The circular debt arises when an operating entity facing problems with outstanding receivables holds back payments to its suppliers and creditors (Kessides, 2013). The lack of payments affects various government departments, generation and distribution companies under the control of KESC and PEPCO, domestic and international fuel suppliers, and refineries in the Pakistani power sector. They affect the fiscal position of the government as a whole.

The circular debt in the power sector had reached PKR 537.5million in 2011, with the potential to lead to shutdown of generation plants and further worsening of demand-supply imbalances in the power sector (Javaid, 2012). The new government at the time settled the existing circular debt through a one-time government subvention of PKR 480 billion in July 2013. However, the issue re-emerged soon afterwards, highlighting the fact that the underlying causal factors had not been effectively addressed. A report commissioned by the Planning Commission of Pakistan identifies the main source to be a difference between the "tariff differential subsidy" (TDS) the government claims to pay to distribution companies versus the amount actually

[13]One US Dollar= NRS. 97 and PKRS. 98 (as of May,2014) and one INR. = 160 NPR.
[14] See also Dossani (2004) for discussion of the reorganization of the Indian distribution sector.
[15] Additional details are in Pargal and Ghosh Banarjee (2014).

disbursed. A second cause is the T&D losses that distribution companies are allowed by NEPRA for tariff determination are lower than the actual levels (GoP, 2013). State Electricity Regulatory Commissions (SERCs) grapple with a similar situation in India (Singh, 2006).

(iv) Limited involvement of the private sector. Attracting foreign and domestic capital through private sector participation in the power sector was one of the major objectives of reforms in SAR (Victor and Heller, 2007). Hence, IPPs were allowed to sell electricity to the grid under state supported long-term contracts in the SAR. Reforms in the region thus have had some success in attracting private sector participation in power generation. For example, in both Nepal and Sri Lanka, IPPs' share of installed generation capacity increased from 21% in 2004[16] to around 33% in 2012 (see Table 3 above). In India, the share of the private sector in the electricity generation capacity has grown to more than 34% by the year 2014 (CEA, 2014). In Pakistan, the share of the private sector increased from 30% in 2004-05 to 49.34% by June 2013 (GoP, 2013). In Bangladesh, the share of private sector in total generation capacity was 40% in July 2014.[17] Nonetheless, many IPP projects built rapidly to address electricity shortages are small in scale and not cost-effective.

Privatization of electricity distribution remains a politically sensitive decision in the region. The Indian state of Orissa was home to the first experiment, in 1999, with privatization of electricity distribution in the region. The initial hiccups in this exercise postponed further attempts at privatization elsewhere. Privatization of electricity distribution in Delhi, in 2002 was remodeled based on the experience in Orissa: it incorporated performance milestones based bidding criteria with declining government support. Evidence indicates that these and other privatized distribution companies have considerable decreases in technical and commercial power losses (IDFC, 2010). Privatization of electricity distribution in Karachi faced political hurdles, making it difficult to implement similar process elsewhere in the country.

[16]See Bhattacharya (2007) for the 2004 data on IPPs' share in generation capacity.
[17]Most of the private sector investments in the electricity sector in South Asia are based on the private sector choosing to invest by itself, though there also have been some Public-Private Partnerships (PPPs). The PPPs have mainly occurred in the power generation segment under build-operate-operate (BOO) arrangements such as in India.

Nonetheless, there is little happening at present in moving toward broader privatization in the distribution segment.

4.3. *Implications of Limited National Sector Reforms on Development of Cross-Border Electricity Cooperation and Trade*

Domestic power sector reforms have an important bearing on the prospects for success in cooperation, cross-border and ultimately regionally (Belyaev, 2011). In particular incomplete domestic power sector reforms can create barriers for facilitating wider electricity cooperation. Some of these barriers are easy to infer from the discussion in the previous subsections. Domestic policy distortions, including investment recovery rules and subsidies in pricing, reduce incentives for expanding generation investment for increased cross-border trade and limit the reward for expanding transmission capacity. Underpriced electricity does not provide effective signals to attract private domestic and foreign investment, as the scope for earning a reasonable rate of return on the capital employed is low. Moreover, investment risks will be higher when erstwhile partners in cross-border investment and trade are in a weak financial condition and may not be able to deliver on promised levels and quality of service.

Weak laws and policies may provide electric utilities with substantial potential to exercise domestic market power. This, in turn, can create barriers to entry for new players in a regional market, even to the point of making competition unsustainable (Green, 2003). Market power issues remain important, as reforms have on many occasions failed to adequately address them (Newbery, 2002). The strong opposition to opening of domestic markets to foreign imports and the resulting interest in anti-competitive policies and practices should not be underestimated (ESMAP, 2010). Weak markets due to regulatory distortions can also complicate long-term contracting for power and make financing cross-border electricity trade more challenging, in particular by creating regulatory risks and limiting options for trading partners.

As previously noted, effective cross-border trade requires institutional capacities for tracking electricity flows, maintaining grid integrity, collecting and transferring revenues, and resolving disputes, among other functions. Inefficient and inertia-

bound domestic electricity sector policies and regulatory institutions impede establishment of the desired quality of cross-border coordination.

5. Conclusions and Implications

Expanded electricity cooperation in SAR can play an important role in long-term economic development of the region. This paper has analyzed the existing state of electricity cooperation in SAR, and considered barriers to increased cross-border cooperation and trade. Some policy, institutional, and political barriers operate at the regional level: lack of confidence and trust, trade-restrictive policies, and challenges in creating effective regional bodies for cross-border coordination.

In addition, political instability and uncertainty and political economy related issues that have limited reforms in regulation of the sector at the national level and led to disappointing sectoral performance also adversely affect opportunities for cross-border electricity cooperation and trade in the region. Sector performance in South Asia continues to be characterized by chronic revenue inadequacy, deteriorating fixed assets and equipment, poor service quality, and severe problems of theft and unpaid bills. Slow progress in addressing these problems also has slowed progress toward achieving greater electricity cooperation and trade in SAR.

Initiatives to engage in cross-border trade of electricity predate the onset of modern domestic power sector reforms. Domestic market reforms are not a precondition for developing cross-border electricity trade, as demonstrated by existing electricity trading arrangements in South Asia. However, power sector reforms in participating countries provide a significant boost to the development of a well-functioning regional electricity market with substantial shared gains for the countries of the region.

Conversely, stronger regional cooperation and trade in electricity can help strengthen domestic sector performance. Cross-border electricity cooperation can help bolster competition in national markets under market-based reforms.[18] It can also improve

[18]For example, Nordpool, as the largest advanced integrated regional wholesale electricity market in the world, has performed well in terms of economic efficiency and competition and provides a good

the functional efficiency of both electricity producers and national regulators, which need to respond effectively to partners in other countries as well as domestic circumstances.

The absence of an SAR level body with adequate resources and influence to help coordinate these elements hinders the intensification of electricity cooperation and trade in the region beyond individual bilateral transactions. A minimum degree of regulatory harmonization is needed for open access to and nondiscriminatory allocation of transmission, without which a power market providing customer choice and competitive returns to private investors cannot flourish. This includes congestion management and transmission pricing. Cross-border electricity trade is also hampered without a system for energy metering, accounting, clearing and payment.

Participation in cross-border electricity trade need not expand all-at-once and at all levels, but can develop in a somewhat piecemeal fashion, with greater opportunities for expanding trade in nations that have adopted widespread electricity market reforms. Policies toward regional electricity integration in SAR can follow a three-track approach based on the existing status of the power sector reforms. In the short term, increased bilateral arrangements between countries based on increased interconnections and cross-border trade can be achieved. This will require agreements based on relatively simple rules for operating the bilateral interconnections between countries.

In the medium term, increased sub-regional integration also involving third parties (such as trade between Nepal and Bangladesh with India as a transit country) can grow. This level of electricity cooperation will require harmonizing access rules, grid codes and protocols and electricity transmission charges. Participating countries also can access short-term power markets in India (and elsewhere as they develop) to meet domestic requirements, as Nepal and Bangladesh already are doing to their advantage.

Intensifying bilateral electricity cooperation in the short and medium term can catalyze and harmonize electricity reforms in the region in the long term. However,

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example of a fuller integration of multiple national electricity systems into a regional market (Glachant and Levque, 2009).

deeper cooperation arrangements are best pursued in the presence of a regional market for power; an organization or forum for cross-country coordination that can help sustain agreements on market access, among other elements; and an institutional mechanism for coordinating and maintaining transmission in an effective and nondiscriminatory manner. Deeper levels of electricity cooperation in turn will depend on a greater degree of harmonization of reforms in national electricity markets, a gradual process. The different stages of regional cooperation can co-exist and gradually converge as sector reforms in the region progress. It must be emphasized, however, that gains from regional cooperation will be limited without development of market institutions and coordination institutions/forum, in addition to the desired domestic policy reforms.

Strong political will and policy continuity remain crucial for achieving higher levels of electricity cooperation considering the lengthiness of the cooperation process. Dismantling political barriers in South Asia to regional electricity cooperation and installing greater economic rationalization in the domestic electricity sectors is indeed challenging but certainly possible.

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APPENDIX

Electricity Sector Reforms In SAR Countries

Here we take a closer look at key individual country experiences and issues.[19]

A.1. India

Power sector reforms in India started in 1991 with the introduction of IPPs as the country faced a severe balance of payment crisis while the performance of the state-owned utilities prior reforms was poor. As such, it is "difficult to imagine more adverse initial conditions" for any electricity restructuring than were present in India at the time of reforms (Wolak, 2008). The first step towards reform included unbundling of the erstwhile state electricity boards (SEBs) and setting up independent State Electricity Regulatory Commissions (SERCs). Beginning with Orissa in 1995, the process was imitated in nine other states. All these states unbundled the state electricity board by creating several distribution companies, one transmission and bulk supply company[20] and several distribution companies (Bhattacharya, 2007, Singh, 2006). The Electricity Regulatory Commissions Act of 1998 led to setting up of the Central Electricity Regulatory Commission (CERC), and enabled setting up of the SERCs in the remaining states by invoking this federal labour legislation, instead of state-level legislation as used by previously reforming states in 2003. However, this did not happen until 2003 while ggeneration[21] and transmission were not privatized in both the States.

Enactment of the Electricity Act 2003 led to deepening of the reform process by lowering market barriers through de-licensing of generation and introduction of non-discriminatory open access of the transmission network, and open access of the distribution network, in phases (Singh, 2010). It is considered as the most comprehensive policy in the region by far (Dossani, 2004; Sinha, 2005; Ryan, 2013). This ushered in an era of 'competition in the market' by introducing licensed traders and by enabling setting up of the power exchanges to encourage wholesale electricity

[19] Information on electricity policies in SAR countries also can be found in ADB (2013).
[20] This bulk supply company acted as a single buyer to purchase electricity from all sources and then sell it onward to the distribution companies. This is known as the single buyer model (SBM).
[21] 49% holding of Orissa Power Generation Company, the generation company of Orissa was sold to a private investor.

trade as a separate activity from the network segments. An Amendment to the Electricity Act 2003 was introduced in 2007 permitting captive power generators to supply power directly to consumers. The country currently has two power exchanges selling dispatchable electricity products, which are primarily dominated by the Day Ahead Market (DAM). In 2012-13, the short-term electricity market, comprised of the trades brokered through the licensed traders and those through the power exchanges, accounted for about 11% of the total electricity generated in the country (Singh et al., 2013). Table A-1 below provides a timeline of the power sector developments in India.

A.2. Bangladesh

In Bangladesh, the electricity sector experienced changes as early as in 1977 with the creation of the Rural Electrification Board and establishment of 70 large distribution cooperatives within it (Rahman, 2008). The pre-reform initiatives such as unbundling initiatives started in early 1990 with the establishment of the Dhaka Electricity Supply Authority (DESA). The first IPP entered in 1992 although the plant was commissioned in 1998. A Power Cell was created under the Ministry of Energy in 1995 to drive power sector reforms and promote economic development in Bangladesh, along with adoption of a National Energy Policy. The Private Sector Power Generation Policy of Bangladesh, issued in 1996, opened up power generation to both local and foreign private investors, offering a number of incentives. Restructuring in the sector continued as the existing utilities were corporatized and their business was reorganised. A long spell of inactivity in the reform process ended in 2003, as the Bangladesh Energy Regulatory Commission (BERC) was established through a legislative initiative and began operation from the next year. The reform process included functional unbundling and independent sector regulation (Alam et al., 2004). Power Grid Company of Bangladesh Limited (PGCB) and Dhaka Electric Supply Company Limited (DESCO) were formed in 1996 (see Table A-2). Foreign investment in the sector was also allowed in the same year. PGCB is a legally unbundled system operator for the electricity transmission network in the country. PGCB was to take over the transmission assets from the Bangladesh Power Development Board (BPDB), which was established in 1972. However, it took seven years for the transfer to be completed (GoB, 2004). Table A-2 below provides a timeline of the power sector developments in Bangladesh.

Table A-1: Timeline of power sector development in India

Year	Description
1991	India Electricity Act (1910) and Electricity Supply Act (1948) amended to attract IPPs (Private Power Policy)
1995	Mega Power Policy; reforms in the state of Orissa; setting up of Orissa Electricity Regulatory Commission
1997	Reforms in the state of Haryana; setting up of Haryana Electricity Regulatory Commission
1998	Reforms in the state of Andra Pradesh (AP); setting up of AP Electricity Regulatory Commission; Act to set up CERC and SERCs; Electricity Laws (amended); Act to allow private participation in transmission
1994	Private Power and Infrastructure Board (PPIB) established to facilitate private investors.
1997	National Electric Power Regulatory Authority (NEPRA) created as an autonomous regulatory agency.
2000	Availability based tariff introduced in Western Region
2001	Energy Conservation Act; Accelerated Power Development Programme, Electricity Bill introduced in Parliament, Accelerated Power Development and Reform Programme launched
2002	Benefits of Mega Power Policy Extended; Restructuring of Delhi Vidyut Board (DVB) and Privatisation of three distribution companies
2003	Electricity Act 2003 enacted; de-licensing thermal generation and to allow open access to usher in a competitive era
2004	Guidelines for Determination of Tariff by Bidding Process for Procurement of Power by Distribution Licensees
2006	Tariff Policy lays out framework for tariff determination including subsidy surcharge.
2006	A scheme for developing is nine Ultra Mega Power Projects (UMPPs), each having a capacity of about 4000 MW, based on coal pit head, and offshore locations using imported coal.
2007	Amendment to the Electricity act 2003; captive power generators allowed to supply power directly to consumers
2008	Re-structured Accelerated Power Development and Reforms Programme (APDRP) launched with a focus on actual, demonstrable performance in terms of sustained loss reduction.
2010	Jawaharlal Nehru National Solar Mission launched to the add 20,000 MW of grid connected solar, 2000 MW off-grid solar applications and 20,000,000 m^2 solar collectors.
2010	Renewable Energy Certificate (REC) mechanism introduced to develop a economically efficient national market for renewable energy.
2014	Electricity (Amendment) Bill proposes to introduce supplier choice for retail consumers and address regulatory gaps, but also seems to compromise regulatory independence.

Source: Updated from Singh (2006, 2010)

Table A-2: Timeline of power sector development in Bangladesh

Year	Description
1972	Bangladesh Power Development Board (BPDB) established.
1977	Rural Electrification Board (REB) established as the semi-autonomous government agency to accelerate rural electricity access.
1978	REB started functioning and conceived 1st project
1991	Dhaka Electricity State Authority (DESA) created.
1993	A high power inter-ministerial Committee on 'Power Sector Reform' constituted.
1995	Power Cell, created under Ministry of Energy & Mineral Resources, to drive power sector reforms and to promote private power development.
1996	Private Sector Power Generation Policy of Bangladesh opens up power generation to both local and foreign private investments, and offers a number of incentives.
1998	Policy Guideline for Small Power Plant (SPP) in Private Sector issued to encourage investors to setup plants up to 10 MW on Build Own Operate (BOO) basis.
1996	National Energy Policy adopted.
1996	Dhaka Electric Supply Company Limited (DESCO) incorporated with the ultimate objective of taking over all assets of DESA.
1996	Power Grid Company Limited of Bangladesh (PGCB) incorporated to take over transmission assets of BPDB and DESA by December 2002.
1998	Power Division established in 1998 under the Ministry of Power, Energy and Mineral Resources.
1998	DESA Act as amended to restructure Dhaka Electric Supply Authority (DESA) into a corporate body with an independent Board of Directors.
1998	DESCO commences commercial operation by taking over Mirpur area from DESA.
1998	Policy Guideline for Small Power Plant (SPP) in Private Sector approved,
2000	Vision Statement and Policy Statement on Power Sector Reforms released.
2002	Transmission assets of DESA (other than those that form integral part of DESA operation) handed over to PGCB.
2003	Bangladesh Energy Regulatory Commission (BERC) established.
2003	PGCB completes taking over of all the transmission assets and operating them.
2004	Private Sector Power Generation Policy of Bangladesh revised.
2008	Renewable Energy Policy of Bangladesh issued to harness the country's renewable energy resources through public as well as private investment.
2008	Policy Guideline for Small Power Plant (SPP) in Private Sector revised.
2008	Policy Guidelines for Enhancement of Private Participation in the Power Sector issued.
2009	The Renewable Energy Policy of Bangladesh adopted.
2010	Power System Master Plan 2010 (PSMP 2010) prepared.
2010	Power and Energy Fast Supply Enhancement (Special Provision) Act enacted to enable the government to bypass the tendering process for setting up new generation plant and transmission facilities for a period of two years.
2011	Power and Energy Sector Road Map outlines the strategy for increasing generation capacity.
2013	A 500 MW back-to-back HVDC interconnection completed with India. This allows import of up to 500 MW of electricity.
2014	Sustainable & Renewable Energy Development Authority (SREDA) set up as a nodal agency for renewable energy, energy efficiency and energy conservation.

Source: Compiled from GoB (2014a, 2014b)

In 2004, Bangladesh revised its policy for private sector investment in generation. Separate guidelines were also issued for promoting small power plants and setting up renewable energy based power generation facilities in the country. In 2010, a Power System Master Plan was prepared. It has forecasted peak electricity demand to grow from 6454 MW in 2010 to 33,708 MW in 2030. To meet this demand, the country would need to develop significant additional electricity generation capacity domestically, and explore importing electricity from neighboring countries in the region. Bangladesh also aims to achieve 100% household electrification by 2021, a challenging task given that the country was able to achieve 49% electrification by 2011 (GoB, 2011). In 2010, the government put in place a Power and Energy Fast Supply Enhancement (Special Provision) Act, empowering it to bypass the tendering process for setting up new generation plant and transmission facilities for a period of two years. This led to signing of contracts with 25 firms to setup about 3000 MW of generation capacity (Ebinger, 2010). These high price contracts necessitated considerable subsidies by the government to hold down retail electricity prices to individual consumers (GoB, 2014a).

A.3. Pakistan

Growing electricity shortages in Pakistan during the 1970s and the first half of 1980s prompted the government to take initiatives to encourage private sector participation in generation of electricity (see Table A-3). A policy document was prepared by the Committee on Private-Sector Power Generation for the Economic Coordination Committee in 1985. This policy provided a framework, as a pre-reform initiative, for private investment in utility scale power plants, which would sell electricity to the then existing electric utilities: the Water and Power Development Authority (WAPDA), and the Karachi Electric Supply Company (KESC) (Little, 1986).

The Power Policy of 1994 opened the generation sector for hydropower projects to private investment by offering better incentives in terms of lucrative tariffs with capacity charges, and guaranteed payments and fuel cost pass through as well as indexation to offset changes in foreign exchange rates and inflation (ADB, 2000). Further, the policy provided for fiscal incentives, including exemption from income tax, sales tax and, custom duty for import of plant and machinery. The Private Power

and Infrastructure Board (PBIB) was created in 1994 to facilitate and monitor private sector investment and infrastructure sectors, including power.

Hydropower Policy 1995 was issued to attract private investment in development of hydroelectric projects by offering an attractive tariff, concessional import duty for import of plant and machinery, facilitation of financing the projects and 'take or pay' arrangement to ensure offtake of power from such projects. Although the “Policy Framework and Package for Incentives for Private Sector Transmission Line Projects in Pakistan” was issued in 1995 to provide attractive incentives to private investors to setup identified transmission lines across the country, investments did not materialize. The policy was tweaked recently in 2015 to provide greater clarity. Power Generation Policy 2002 specifically highlighted the role of the private sector in contributing significant capacity additions following a reform program in the country.

An unfavorable macroeconomic environment due to regional-scale financial crises in the late 1990s created severe liquidity constraints on the public sector utilities, namely WAPDA and KESC, which deferred payments to IPPs. Nonetheless, this policy did not contribute towards privatization of KESC or unbundling of WAPDA. KESC was eventually privatized later in 2005. The National Electric Power Regulatory Authority (NEPRA) was established in 1995 based on a Presidential Ordinance. Later, enactment of the'Regulation of Generation, Transmission and Distribution of Electric Power, as Act No. XL of 1997' led to its formal creation and notification. The five-member commission is empowered to issue licenses, determine tariffs and set standards for performance (GoP, 1997). The transfer of KESC was only completed in 2005, although the process started in 1996 with further capital restructuring carried out in 2002 and 2003 (Bhattacharya, 2007). The restructuring of WAPDA began in 1998 through the creation of the Pakistan Electric Power Company (PEPCO), which was responsible for managing the transition of WAPDA from a bureaucratic structure to a corporate, commercially viable and productive entity (USAID, 2010). In 2007, thermal power generation, transmission, distribution and billing activities of WAPDA were entrusted to PEPCO. WAPDA remains responsible for water and hydropower development only. PEPCO is currently responsible for nine Distribution Companies (DISCOs), four Generation Companies (GENCOs) and a National Transmission Dispatch Company (NTDC). The NTDC was set up and commenced operation in

1998. These companies are working under independent Board of Directors and are administratively autonomous. WAPDA also owns and operates the Hyderabad Electric Supply Company (HESCO) commencing business in 1998.

A.4. Sri Lanka

The power sector in Sri Lanka is dominated by two utilities, namely Ceylon Electricity Board (CEB) and Lanka Electricity Company (LECO). CEB is an integrated utility composed of six business units fully owned by the government and engages in the generation (one), transmission (one) and distribution (four) of electricity (ADB, 2004). LECO was created in 1983 as a distribution company under the Companies Act No.17 of 1982 (later, the Companies Act No. 07of 2007). The CEB (50%) and the Government Treasury (44%) own most of its shares. In 1992, the CEB invited expression of interest (EOI) to set up generation plants in the country (Poulin and Roth, 1994), opening up the entry for IPPs. A severe drought during 1996 led the government to promote IPP entry in thermal generation. A feasibility study for a 40 MW diesel based plant that was also commissioned in 1998.

The restructuring efforts started in 1998 with the government establishing the Public Utilities Commission of Sri Lanka (PUCSL) in 2002 as a regulator for electricity, lubricants[22] and water sectors under Act No. 35 of 2002 by the Parliament. PUSCL came into operation in 2003. The Commission regulates the generation, transmission, distribution, supply and use of electricity (PUSCL, 2014a). Initially, PUSCL was not empowered to determine tariffs but after the 2009 Act, the commission achieved real powers to regulate tariffs (Amarawickrama and Hunt, 2004). The Sri Lankan Parliament passed the Sri Lanka Electricity Act No. 20 of 2009 to replace the Electricity Reform Act 2002 with the major aim of empowering the PUSCL to effectively regulate the power sector (PUSCL, 2014b). However the Act did not become fully effective because of factors such as changing governments and public opposition, limiting the PUSCL to its advisory roles only while the Act in itself had too little to empower the commission.

[22] PUCSL is a shadow regulator of the lubricants market in Sri Lanka. Appropriate legislative initiatives were proposed to be undertaken to empower PUCSL to regulate the petroleum industry.

Table A-3: Timeline of power sector development in Pakistan

Year	Description
1958	Water and Power Development Authority (WAPDA) was established as a semi-autonomous agency to coordinate the development of Pakistan's water and power resources.
1992	Government prepared the strategic plan for the privatization of the power sector
1992	National Pakistan Conservation Strategy (PNCS) was enacted, which was subsequently integrated into the ninth Pakistani energy plan (1993-1998).
1994	Power Policy issued to invite independent power producers (IPPs) to invest in sector.
1994	Private Power and Infrastructure Board (PPIB) established to facilitate private investors.
1995	Policy Framework and Package for Incentives for Private Sector Transmission Line Projects in Pakistan
1997	National Electric Power Regulatory Authority (NEPRA) created as an autonomous regulatory agency.
2000	NEPRA directly attached with the Cabinet Division.
2005	KESC privatized by offloading 73% stake. However, the winning bidder withdrew after four months.
2008	Management control of KESC transferred to a new private entity.
2010	New Ordinances make NEPRA to determine overall electricity tariff on a quarterly basis.
2013	National Power Policy 2013 issued by the Ministry of Water and Power. The policy identifies specific actions to achieve 9 goals including creation of additional capacity, encourage energy conservation is a, minimise inefficiencies of the distribution system and improving governance at all levels.
2014	National Power Tariff and Subsidy Policy Guidelines 2014
2014	NEPRA issues draft Competitive Bidding Tariff (Approval Procedure) Regulations, 2014
2015	Revised Policy Framework for Private Sector Transmission Line Projects issued. It includes 10 year income tax exemption and other fiscal incentives.

Source: Compiled from GoP (1997, 2013); NEPRA (2014)

The Sri Lankan attempt over 25 years to privatize the CEB has faced mass opposition from trade unions fearing job losses. The government is keen to privatize the power sector as a means to raise money and relieve the financial burden of the heavily indebted CEB. An attempt to sell the CEB failed in 2002 due to protests by the workers while the passing of the power reform bill in 2009 also faced opposition from some trade unions.

The transmission, bulk purchase of power as well as distribution within its own areas remained a monopoly of the CEB. Competition was brought about by tendering requirement for procurement of power by the CEB. This was also modified later, see Table A-4 below. CEB's monopoly continues to remain as a single buyer of electricity.

Sri Lanka Sustainable Energy Authority Act, No. 35 of 2007 aims to promote development of renewable energy based electricity generation by giving incentives to private investors. Sec. 16 (b) of Sri Lanka Electricity Act No. 20 of 2009, mandates a generation licensee to sell electricity to the transmission and bulk supply licensee, i.e. the CEB. Presence of the single buyer model (SBM) limits competition in the electricity sector in Sri Lanka. reviewed the policy and regulatory environment and suggested the need for initiatives, including open access of the network to enable competition in the power sector in Sri Lanka.

The Electricity Act of 2009 (Sec. 43(2)), introduced a semblance of competition by mandating competitive tendering process for procurement of electricity by the Transmission and Bulk Supply licensee (i.e. CEB). However, in 2013, Sri Lanka Electricity (Amendment) Act, No. 31 of 2013 dropped this tendering requirement for setting up new plants or expansion of existing power plantsunder an offer from a foreign sovereign government with the approval of theCabinet of Ministers.

A.5. Nepal

Pre-reform efforts and initiatives in electricity sector in Nepal started with the establishment of the Nepal Electricity Authority (NEA) by merging various state-owned electricity entities in 1985, with the introduction of the NEA Act 1984. NEA remains vertically integrated with functional separation in terms of generation, transmission and distribution of electricity. The Department of Electricity Development (DOED) continues to be the licensing authority for generation, transmission and distribution of electricity in Nepal.

Table A-4: Timeline of power sector development in Sri Lanka

Year	Description
1935	Electricity Board of Ceylon (EBC) established.
1937	EBC and all functions of ECB transferred to its former department by renaming as the Department of Government Electrical Undertakings (DGEU).
1969	Ceylon Electricity Board Act, No. 17 of 1969, led to setting up of the CEB.
1992	EDB invites expression of interest for setting up privately owned power plants.
1993	Lanka Electricity Company Limited (LECO) established to undertake, distribution and supply of electricity in its franchise area along the coastal belt of the Western Province and part of the Southern Province.
2002	Electricity Reform Act, No. 28 of 2002, enacted to regulate and restructure the sector. However, its key provisions leading to unbundling of Ceylon Electricity Board (CEB) and the Lanka Electricity Company Pvt. Ltd (LECO) are not yet implemented.
2002	Enactment of Public Utilities Commission of Sri Lanka Act, No. 35 of 2002 , leading to setting up of the PUCSL, a multi-sector regulator including electricity.
2002	Sri Lanka Rural Electrification Policy issued to provide a level playing field between grid connected and off grid renewable energy applications by providing transparent subsidies, network access and cost-effective tariffs.
2007	Sri Lanka Sustainable Energy Authority set up under the Sri Lanka Sustainable Energy Authority Act, No. 35 of 2007, to achieve sustainability in energy supply through development of indigenous resources and energy conservation.
2008	National Energy Policy & Strategies of Sri Lanka' incorporates 9 key elements including ensuring basic energy needs, improving energy security, promoting renewable energy, promoting energy conservation and adoption of course reflective tariffs with targeted subsidies.
2009	Sri Lanka Electricity Act, No. 20 of 2009 strengthens the PUCSL to deliver on its responsibilities, among others, for licensing, tariff setting, and setting technical and operational codes.
2013	Sri Lanka Electricity (Amendment) Act, No. 31 of 2013, does away with tendering requirement (Section 43) for setting up new plants or expansion of existing plants under an offer from a foreign sovereign Government with the approval of theCabinet of Ministers.

Source: Compiled from ADB (2004), PUSCL (2014b)

The formulation of the Hydropower Development Policy 1992, Water Resources Act 1992 and the Electricity Act, 2049[23] (1992) paved the way towards creating a legal framework for the corporatization of the power sector although corporatization efforts have not been exercised (ADB, 1999). The Hydropower Development Policy 1992 opened the generation segment for IPPs, as the focus was to promote and facilitate

[23] Nepali Year (NY). Year in parenthesis refers to the Gregorian year.

hydropower development while allowing for private sector participation. The NEA Act was amended to provide 'autonomy' to the NEA and it became a licensee to buy electricity generated by private IPPs's). The Electricity Tariff Fixation Rules 2050 (1994) issued under Section 40 of Electricity Act, 2049 (1992)led to the establishment of the Electricity and Tariff Fixation Commission (ETFC) in 1994 to regulate electricity prices.

The Hydropower Policy 2058 (2001) was issued with an intention to attract more foreign and domestic private sector investments, with ETFC to be developed as a regulatory body (Nepal and Jamasb, 2012a). The 2001 policy also recognized the need to develop hydropower as an 'exportable commodity' (GoN, 2001). ETFC revised electricity prices in 2001 by hiking the tariffs. The policy prompted establishment of the Independent Power Producers' Association Nepal (IPPAN) in 2001 with the intention of encouraging private sector involvement in hydropower development.

The Community Electricity Distribution Bylaw was introduced by the NEA in 2003 with the objectives of promoting public participation in reducing non-technical power losses (such as theft), institutionalising distribution and encouraging community management in the extension of distribution lines through the distribution institution[24] (NEA, 2014). The aim of the initiative was to enable such institutions to extend distribution lines and purchase of electricity in bulk from NEA for selling it on to the consumers.

Changes in leadership and political instability led to the ETFC being dissolved in 2011 while a period of national ‘energy emergency’ was declared. Another change in political leadership later in the same year reinstated the status of ETFC. The ETFC subsequently approved a price hike for electricity in 2012, eleven years after the last price adjustment.

[24] A 'Distribution Institution' can be a company, a cooperative, an association, an NGO or users association, duly registered under respective laws.

Table A-5: Timeline of power sector development in Nepal

Year	Description
1984	Nepal Electricity Authority Act, 1984 enacted to set up Nepal Electricity Authority.
1992	The Industrial Enterprises Act, 1992 enacted to facilitate investment in industrial sectors including generation of electricity.
1992	Water Resources Act, 2049 (1992) , enacted vesting ownership of water resources with the government and mandating license for harnessing the same.
1992	Hydropower Development Policy 2049 (1992) issued.
1992	Electricity Act, 2049 (1992) enacted. It specifies rules to apply for licences to conduct survey, generation, transmission or distribution of electricity.
1992	The NEA Act amended to "enable the NEA to function autonomously". NEA transformed from being a a sole player to a licensee to buy electricity generated by private IPPs's.
1993	Electricity Regulations, 1993, introduced to operationalize the Electricity Act, 1992 to enable entry of IPPs.
2001	Electricity Leakage Control Act (2058), 2001 is enacted to reduce theft of electricity.
2001	Hydro-Power Development Policy, (2058) 2001 issued to develop country's hydro resources including those for export purposes.
2003	NEA frames Community Electricity Distribution Bylaw 2060 (2003) to encourage public participation in distribution and attract private investment for rural electrification. This is followed by the establishment of Community Rural Electrification Department (CRED).
2006	Rural Energy Policy 2006 issued to address, among others, the energy needs of the rural population, creation of a rural energy subsidy scheme with clear objectives and criteria for target groups and incorporation of rural energy policies of ministries and institutions related to rural development.
2008	Amidst growing power shortages, a 38-point National Electricity Crisis Resolution Action Plan (2065) 2008 was introduced. This includes provisions for PPA at flat rate for power plants up to 25 MW, 7-year income tax holiday and waiver of the provision for conducting Environmental Impact Assessment (EIA) for projects expected to be implemented by Chaitra 2068 (2011).
2013	Subsidy Policy for Renewable Energy (2069) issued to increase access to renewable energy to low-income households through subsidy and access to credit, to support rural electrification and to attract private investors.

Source: Compiled from Nepal and Jamasb (2012a); NEA (2014)

In the meantime, the Hydropower Development Policy 2058 (2001) imposed a tax on electricity to be exported from the country (Singh et al., 2013).The proposed

Electricity Bill, 2065 and the Nepal Electricity Regulatory Commission Bill, 2065 envisions regulatory reforms leading to setting up of the Nepal Electricity Regulatory Commission (NERC). Power sector reform in Nepal, hence, continues to lag behind other countries in the region in terms of the pace and the scope of reform in the power sector.